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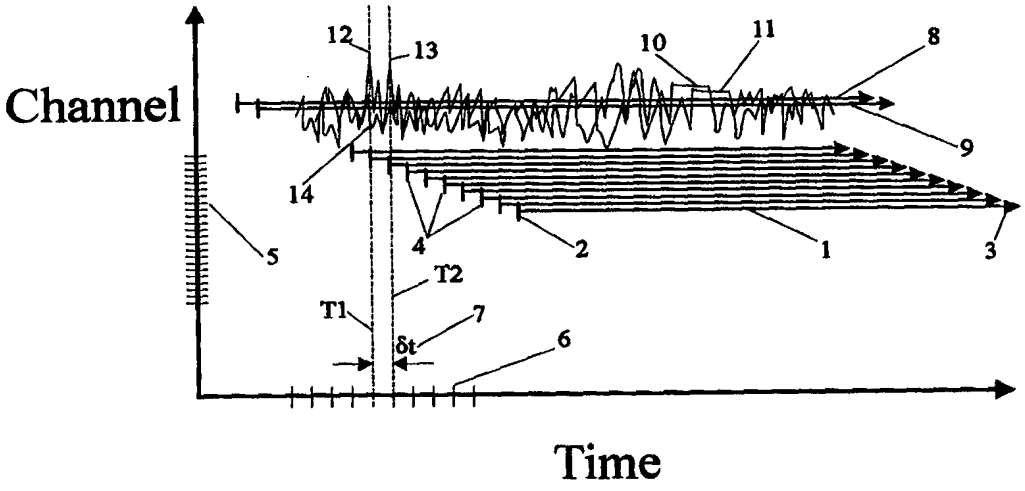

(57) Abstract

A high performance one-way communication system provides transmission of information on multiple channels to enable advanced receive functions. In particular, manipulation or switching of receive signals allows advanced functionality at the receiver with respect to signal time. A unique transmission protocol allows a user to direct receipt of content without the requirement of establishing a communication "up-link". Systems include a transmit end, and receive end and a transmission link which couples the two ends. The transmit end is arranged to transmit a plurality of signals (4) on a plurality of channels in a predetermined format having regular structure with respect to time. The receive end, is arranged to cooperate with the transmission protocol such that dynamic receipt of the plurality of signals (4) enables advanced features without need to transmit requests from the receiver to the transmitter. As such, advanced features typically found in a two-way asymmetrical systems are realized in a one-way system with simple design and reduced power requirements.

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Title: "Technique for Time Manipulation of Multi-Channel Transmission System"

Description of Invention under PCT

BACKGROUND OF THE INVENTION

Field

This invention is generally concerned with transmission of information on multi-channel, single-direction transmission systems and specifically concerned with schemes to enable high performance characteristics with respect to time manipulation in signal space.

Prior Art

Communication systems are highly diverse in their design and function. Both equipment, or hardware, and communication protocol, or software, may vary considerably from one system to another. Hardware and protocol for information exchange varies in accordance with any particular task at hand. In a very broad sense, communication systems may be classified as "two-way" and "one-way" systems. A communications system may be thought of as two stations linked together by a transmission link. A bi-directional or two-way system sends and receives information at both terminal ends of the system; while a one-way system provides a transmit only function at a server end and a receive only function at a client end.

A one-way system may be further characterized as having transmitter which broadcasts a signal which may be received at a remote unit. The remote unit may be very simple in design and power requirements as it does not require a transmitter for producing return signals. Although the design is simple, the flow of information is limited to a single direction. A radio in an automobile is a good example of a one-way, or receive only system.

A two-way system stands in contrast and is characterized by its arrangement which includes two or more transceivers being in communication with each other. Each unit includes both a transmitter and a receiver. Information may be passed to and from each of the units. A cellular telephone system illustrates a typical two-way system.

A special class of two-way systems is sometimes referred to as an "asymmetrical" system. Like the one way system, information primarily flows from a server to a client. However, the client may transmit a low bandwidth "request" to the server which tends to direct the topic or the content of information which is transmitted thereafter. The "request" is typically a very brief message. On the other hand, the content dispensed by the server is typically quite extensive in quantity. More generally, the system may be described as a very high bandwidth in one direction and a low bandwidth in the other; hence an 'asymmetrical' system. Some Internet web pages deliver detailed content in response to simple low bandwidth requests. An Internet link to a web page is a good example of an asymmetrical transmission system.

These systems and each of them have unique properties which are useful in certain applications. However, they are also accompanied by limitations which may tend to make the systems less than ideal. A particular example is illustrated below in which the transmission of video signals for television is discussed. In particular, an asymmetrical system known as "video-on-demand" shows how such systems might be unnecessarily complex and with limitation which is undesirable.

In contrast, a conventional television, a one-way system, is limited because a small number of programs are broadcast on a plurality of channels. Although a user may select between the channels, one cannot select which programs are being broadcast on those channels. A user of conventional television broadcast signals has no ability to request receipt of particular programs. The user must watch the program when it is transmitted and has no ability to change the time of receipt. A user has no ability to advance or retard the signal. There is no possibility for a user to freeze frame, slow-motion, et cetera.

Video-on-demand is a relatively new technology which promises to improve television receivers so they may receive programs which are requested by a viewer.

Video-on-demand therefore provides a user greater programming choices. However, video-on-demand systems require information transmission in two

directions. i.e. the server must receive requests from the client. This complicates the system quite considerably. A video-on-demand customer, or "client" user, may transmit a request to a server station to receive a particular video program. In response to the request, the server station transmits the selected program. This two-way asymmetric system allows a user to be highly selective with respect to programs which can be received. However, the "up-link" or the means of transmitting a user request to a server is problematic. Cable which is used to deliver video to customers was designed as a one-way system. Consequently, repeaters and amplifiers in the system may not support transmission in two directions. It is possible to establish communication from a client to a server by alternative means. For example, a simple telephone may serve as the up-link. A user might call a dedicated number and make requests by composing a certain tones in response to a server computer voice menu. The server then may respond to the request by starting transmission on regular transmission cable the requested video. As such a video "start" command is established by a telephone request.

Since this technique is quite cumbersome, it may be used to order video in large segments such as a complete movie. However, it is prohibitively difficult to establish a telephone up-link to affect commands such as stop, pause, rewind, fast-forward, freeze frame, slow-motion, et cetera. A new telephone call and command would be required for each of these functions and sometimes more than one call would be needed thus complicating the up-link further.

Notwithstanding, techniques have been discovered which provide very novel uses of communication systems, particularly with respect to organization of such systems to enable a true one-way system with the high performance generally found in a more complex and versatile two-way device. A client receiver having no transmission capacity whatever is enabled with advanced function which allows it to perform more like a high quality two-way asymmetric system.

While the systems and inventions of the prior art are designed to achieve particular goals and objectives, some of those being no less than remarkable, these systems have limitations which prevent their use in new ways now possible. These prior art inventions are not used and cannot be used to realize the advantages and objectives of the present invention.

SUMMARY OF THE INVENTION

Comes now, John, Thomas and Peter Ellenby with an invention of a high performance one-way communication system which provides transmission of information on multiple channels to enable advanced function with respect to time manipulation of received signals. A unique transmission protocol and special manipulation of signals at a receive end allow a user to direct receipt of content without the requirement of establishing a communication "up-link" having undesirable limitation.

The system is generally comprised of a transmit end, and receive end and a transmission link which couples the two ends. The transmit end is arranged to transmit signals or a signal on a plurality of channels in a pre-determined format having regular structure with respect to time. The receive end, is arranged to cooperate with the transmission protocol such that dynamic receipt of signals enables advanced features without need to transmit requests from the receiver to the transmitter. As such, advanced features typically found in a two-way asymmetrical systems are realized in a one-way system with simple design and reduced power requirements.

In brief, a broadcast system is arranged to transmit information on a great plurality of channels in a pre-determined scheme. Each channel may carry specific information and the relationship between the channels and the information carried therein is well organized. By distributing information about a plurality of transmission channels in a highly organized and pre-determined fashion which is "known" to a receiver, and programming the receiver to manipulate that organization scheme, the receiver may change channels in a highly dynamic manner in response to certain stimuli to realize advanced function and performance.

Accordingly, an apparatus for transmission of information comprising: a receive only terminal end; a transmit only terminal end; and a transmission link, the terminal ends each being coupled to said transmission link, whereby the transmission link includes a multiple transmission channels, each channel being arranged to carry an identical signal, a signal being transmitted on a first channel having an offset in time with respect to the signal being transmitted on a second channel, and whereby the transmit only terminal end includes a multiplexer characterized by a single input and a plurality of outputs, whereby a signal on said input is delivered to each of said outputs in sequence, each of said outputs having the same signal displaced in time, and finally

whereby the receive only terminal end has a demultiplexer characterized by a plurality of inputs and a single output, whereby a single signal received on either of the inputs is delivered to the output.

It is therefore a primary function of this communications system to provide versatility and high performance of two directional systems in a simple and inexpensive one-way system. It is a contrast to prior art methods and devices that present systems do not require receive units to have any transmit function whatever. A fundamental difference between systems of the instant invention and those of the art can be found when considering its unique arrangements of signals on transmission channels which enables the device to perform like a two-way system without need for a transmitter at a client end. Systems of the invention enjoy dynamic properties of a two-way system while retaining the simplicity of a one-way system where the receiver have no transmission function at all.

Objectives of the Invention

It is a primary objective of the invention to provide a communication system.

It is an object to provide a highly functional one-way communication system.

It is an object of the invention to provide one-way communication systems with advanced function which is controllable by a system user.

It is an object to provide the receive end of a one-way system with highly dynamic function.

A better understanding can be had with reference to the detailed description of Preferred Embodiments and with reference to the appended drawings. These embodiments represent particular ways to realize the invention and are not inclusive of all ways possible. Therefore, there may exist embodiments that do not deviate from the spirit and scope of this disclosure as set forth by the claims, but do not appear here as specific examples. It will be appreciated that a great plurality of alternative versions are possible.

BRIEF DESCRIPTION OF THE DRAWING FIGURES

These and other features, aspects, and advantages of the present invention will become better understood with regard to the following description, appended claims and drawings where:

Figure 1 is a block diagram which shows a simple version of a transmitter, receiver and link of the invention;

Figure 2 is a detail drawing of a demuliplexing portion of a receiver of the invention showing relation between a user input, command driver, and signal inputs and outputs; and

Figure 3 is timing schematic showing a relationship between selected channels and time.

PREFERRED EMBODIMENTS OF THE INVENTION

Systems of the invention are generally comprised of a server end, a client end and a transmission link which couples the two ends. The server end is arranged to transmit a signal on a plurality of channels in a pre-set format having regular structure with respect to time. The client end, is arranged to cooperate with the transmission protocol such that dynamic receipt of signals enables advanced features and function related to time without need to transmit requests from the client to the server. Some of the functions include but are not limited to: "start" or "play", "stop", "pause", "fast-forward", "rewind", "freeze frame", "slow-" and "fast-motion" play, et cetera.

The system is best presented in two sections which relate most generally to hardware and to transmission protocol.

So that one may more easily understand the following description, a brief review of certain nomenclature and definition of terms as used in the following description is presented here. For purposes of this disclosure:

A **communication system** may include a server, a client, and a link which couples the two. The server is the source of information to be conveyed and the client is the receiver and requester of that information. Information may be any intelligible data in analog or digital format which may be represented by a modulated signal such as a propagation electromagnetic wave. Radio spectrum, high frequency, HF; very high frequency, VHF; ultra high frequency, UHF; infrared, IR; et cetera, all provide spectra which may carry information via modulated signals. An information set may be called a program. Programs may be further divided into segments.

A **transmitter** is a device which forms and broadcasts signals which represents information.

A **receiver** is a device which can receive and decode signals and present received information in a usable form.

signal space is defined as a two dimensional coordinate system where signal modulation is represented on the ordinate and time is represented on the abscissa.

A **transmission channel** is a discrete conduit which may be distinct from other channels. A "transmission channel" includes conventional channels characterized by a spectrally distinct band, or "frequency" or may further include more advanced schemes where several channels share a single frequency. Popular techniques for providing such configuration include time division multiple access, TDMA or code division multiple access, CDMA techniques. By use of the term "channel" in this disclosure, it is intended that both frequency bands and these and other advanced techniques provide transmission channels are included.

While it is very convenient to use a video signal as an example and one is used extensively throughout this disclosure, the reader should be advised that the system is in no way limited thereto or intended to be designed for video systems. The example of video is used for its clarity and its relationship with certain functions which are discussed. Indeed, the invention will serve well transmission of many other types of data and information. For example, audio programs will enjoy the benefits, features and advantages which accompany systems of the invention. One should maintain the idea that systems of the invention are directed to communication systems in general and will work to realize advantages for all communication systems employing the principles taught herein.

Hardware

Best modes of the invention include apparatus for transmission of information which are comprised of a transmitter, a receiver, and a transmission link therebetween. With reference to the drawing figures, and in particular Figure 1, which shows a block diagram of a simple version of a transmitter, receiver, and link. A transmitter 1, includes a specially arranged device which multiplexes a signal to be transmitted among a plurality of transmission channels. The multiplexer 2 may be arranged to distribute a signal 3 over a great plurality of channels. A transmission link 4 couples the transmitter with a receiver 5. The receiver is equipped with a specially arranged

demultiplexer 6. The demultiplexer receives transmission of signals on a plurality of channels and provides a single signal 7 at its output. The multiplexer 2 has a single input 8 and a plurality of outputs 9. Similarly, the demultiplexer has a plurality of inputs 10 and a single output 11.

With reference to drawing Figure 2, one can appreciate further detail of the demultiplexer. The demultiplexer 21 and its plurality of receiver channels 22 cooperate with output 23 via a command controller 24 which is directed and motivated by a user interface device 25. Receive channels are in communication 26 with the command driver. The user interface device is similarly connected 27 to the command driver. The user interface device may include multiple simple push buttons 28 which can be used to initiate desired receiver function.

Each of the elements above can be presented in further detail as follows:

Transmitter

An example of a transmitter may be a video playing device compatible with common video formats and systems. Video signals which may be stored in analog or digital storage systems may be played by a transmitter of the invention. The transmitter may present signals for transmission on either conventional cabling systems or on more modern wireless systems. The transmitter may include sophisticated electronic hardware operable for manipulation of video signals and in particular for processing them for transmission on a plurality of channels

Multiplexer

A signal which is applied to the multiplexer input is subject to a special processing and is distributed to output transmission channels in an ordered fashion. A video program may be encoded as a modulated electromagnetic signal. Briefly, the signal may be reproduced or replicated by the multiplexer into several identical signals. Each identical signal being transmitted on a different channel. The identical signals each having a beginning and an end, can be staggered in time such that a first channel has a slight time delay with respect to a second; a third channel having a similar time delay with respect to the second, and so on for all channels.

Transmission Link

A transmitter and receiver of the invention are coupled by a transmission link. A transmission link may be radio broadcast, fiber optic, wireless, infra-red optical, or many alternative others without deviation from the spirit of the invention. A

transmission link of the invention is characterized by having a great plurality of channels.

As mentioned, a channel includes conventional channels characterized by a "frequency" or may further include schemes where several channels share a single frequency. Both time division multiple access, TDMA and code division multiple access, CDMA techniques may operate to provide a transmission link with many channels onto which signal may be distributed.

Receiver

A receiver may be a common television tuner which has been arranged to cooperate with and receive the channels of the transmission link of the invention. A receiver includes elements unique to the invention including a demultiplexer, a command driver, and a user interface device.

Demultiplexer

A demultiplexer operates to receive information signals on many channels and is highly agile as it switches channels and routes signals received on any of the channels to a receiver output for playback on a video device. Channel switching routines may be driven by a command driver and a demultiplexer of the invention is responsive thereto. One should be fully advised that a demultiplexer does not imply that physical electronic receive circuits be in place for each channel which is transmitted. The icons represented as 10 in Figure 1, and 22 in Figure 2 do not necessarily correspond to actual physical objects, such as antennae or receive circuitry, but merely imply that the demultiplexer is operable for tuning to each of those receive channels. Indeed, some versions will have only one electronic circuit which can receives signals. That circuit being *tunable* to many channels. The demultiplexer then is said to operably receive many channels without implication that it simultaneously receives more than one channel at a time.

Command Driver

A command driver includes routines which drive changing of receive channels. The signals on certain receive channels are more desirable than others at any given time. The command driver receives requests from a user and responds to those requests by selecting the appropriate channel changing sequence to carry out the function requested by the user.

User interface device

A user interface device may be comprised of simple buttons which operate electronic switching in response to tactile inputs from a user. Electronic switching then initiates routines which may be executed by the command driver to select channels in accordance with a particular function.

Transmission Protocol

The transmitter end transmits information simultaneously on a plurality of channels. For illustration purposes, an example is devised which has a video program having a length of one hour. The program is broadcast on 3,600 independent transmission channels. The entire program is transmitted as a modulated signal with respect to time, from its start to finish, on each of the 3,600 channels. The "start" time for *each* channel is offset by one second.

Receivers of the invention are arranged to be extremely agile with respect to changing channels. Receivers of the invention have many mechanisms which stimulate the changing of channels in a particular order and manner which serves some function.

A user receiving the program may have a receiver which may remain tuned to a single channel during normal play. The signal is received on that channel in a continuous serial manner as it is broadcast onto that channel as such. If a user's attention is disturbed and the user misses a portion of the program, a "rewind" operation may be desired. The user may initiate a rewind function by indicating desire for such via a user interface device. The command driver being prepared with the transmission sequence in relation to the operating channels in advance, could switch channels one at a time while the user maintains activation of a rewind switch. The channel switching effectively moves the receiver back in "program time" or signal space. A newly selected channel has a start time which is "later" than the start time of the program transmitted on the initial channel. The channel may be switched at any rate which is convenient for rewind functions and the program may be "rewound" to any point in the program with the only limitation being the resolution of the rewind steps. Due to the finite number of channels in the example, the rewind mechanism for this illustration has a one-second increment and it is impossible to rewind the program .5 seconds as there is no channel which can be selected to perform such function. However, one can appreciate how useful it would be to rewind programs where this limitation would only be a small inconvenience. If higher resolutions are required, then

more channels may be provided. A system having 108,000 channels can have a rewind step equivalent to standard video, i.e. 1/30 of a second. [[note that no resolution is lost in normal video frame rates or picture quality]].

One might gain a greater appreciation in consideration of the drawing Figure 3. A signal may be represented by an arrow 1 having an end 2 which represents the start of a program and an end 3 which represent the finish of a program. A plurality of signals 4, each being transmitted on a separate transmission channel 5 are staggered to start at a different time 6 so that one signal on one channel begins a time δt 7 later that a second signal on a second channel. Of course, an arrow represents the signal in time but not amplitude. To show a signal in amplitude, arrows 8 and 9 have been prepared and set aside. On those arrows a modulated program signal is drawn. One will appreciate that each of the arrows in the drawing is meant to represent such signals where the modulation part has been left off in order to make the drawing more clear.

The careful observer will notice the signal portion 10 on the channel represented by arrow 8 is identical to the signal portion 11 of arrow/channel 9. The offset between the signals is a time offset in the amount of δt.

Special processor 12 may be added to manage: receipt from a dedicated ancillary channel, storage in a memory, and playback of special information topics or non-program data which relate to advertisement, custom designs, and screen saver video which may be played independently of regular programming. Further details follow in sections presented later.

A preferred embodiment illustrates how a system might be arranged to accomplish a "fast-forward" or "rewind" function where a program is advanced or retarded in response to manual stimulation provided by a user. The reader will appreciate that nothing is actually "rewound" or spooled in the mechanical sense but that language is used as it is closely drawn to the timing sequence of a program in play. At a rate greater than the time interval between channels. The greater the ratio, the higher the rewind speed. One will appreciate the rewind speed is thus variable without limit. In fact, it is now possible to "rewind" an entire program signal instantaneously.

A receiver tuned to channel 8 and receiving that signal may be retarded and receipt of the program will effectively be delayed by switching the receive channel to channel 9. This can be verified by closely examining the identical program points of

the two channels 12 and 13. A user on channel 8 would receive a "peak" 12 at time T1. If at that instant the channel is switched to channel 9, the receiver would receive the signal indicated by 14. 14 indicates a spot in the program before the "peak" has arrived. The user would in one second receive the peak at 13. However, that peak has been already received when the receiver was tuned to channel 8. The program portion from 14 to 13 is actually received twice. Repeating this process many times affects a "rewind" function merely by switching channels in agreement with a pre-defined transmission scheme.

In some preferred versions, a special ancillary channel may be reserved for transmission of a schedule of programming, channels and corresponding start times. Arranged in a matrix or a "look-up" table, this information may be received and stored in a receiver memory. The information may then be quickly accessed by the command driver and the information may be used to direct and control further function. An example of how this may be affected follows as an alternative to the "pause" function described below.

Now with the communication protocol firmly in place, one can enjoy a full understanding of various time manipulations to vary the reception of the program with respect to program time. Since the receiver is highly dynamic in its ability to change channels, and is well acquainted with the transmission protocol, several functions which relate to manipulation of program time can be realized simply by switching receive channels. These may include but are not limited to functions such as "play" or "start", "stop", "pause", "fast-forward", "rewind", "freeze frame", "slow-" and "fast-motion" play, et cetera.

A "Start" function works as follows:

A "start" or "play" command may be executed by a user who presses a "start" command key on a user interface device. In response to the action, a command driver responds by executing code to look for a channel which contains a video "start" marker or header. The command driver then tunes to that channel and locks thereon. The demultiplexer applies the signal received on that channel to the receiver output for play on a video device. The channel remains continuously tuned to the same channel as time advances allowing normal play of the signal. As long as a play mode is desired, no further channel changing is required.

A "Stop" function works as follows:

A "stop" command may be effected by merely disengaging the demultiplexer output from all the receive channels such that no signal at all appears on the demultiplexer output.

A "Pause" works as follows:

One will most certainly appreciate how convenient it would be to "pause" the evening news program while tending to matters which otherwise might interrupt such programs. A pause function is executed when a "pause" button on a user interface device activates the demultiplexer to switch in an appropriate manner. A pause function is used to hold program time from further advance with the intention of later resuming play from the point in time where the pause function was initiated.

To produce a pause function, receivers of the invention may be arranged with a channel changing mechanism which switches channels in step with actual time. For the example presented above, the channels are continuously switched at a rate of one per second to channels having a later start time. When the pause function is disengaged channel switching stops and the receiver again locks onto a single channel.

A careful observer will appreciate that alternative techniques of accomplishing the same function are possible. One of the preferred techniques includes use of a look-up table which has been transmitted and received on a special channel. A look-up table or matrix of program start times that relate to a reference clock such as present time and corresponding channels allows a command driver routine to compute which channel should be tuned in order to realize a desired function. For example, when a user initiates a pause function, the command driver may simply disengage the channel presently in tune from the receiver output, and record a program time stamp or a program elapsed time to mark when the pause function was initiated. When the pause function is to be terminated and the program is to be continued, the elapsed time is subtracted from the reference clock time. The channel having a start time equivalent to that result becomes the new tuned channel. In this way, one can find the channel at any time which will allow replay of the video from the point where the pause was initiated. Thus, a look-up table relieves the system from continuous switching in agreement with a strict timing scheme.

While the system is "paused", the output can be connected to a stored frame having an advertisement or special promotional logo or user chosen screen saver frame or video sequence which is totally unrelated to the program being received. An

additional ancillary channel may be provided for transmission of such topics. A special processor can be arranged to receive and manage this type of function.

A "Rewind" function works as follows:

A command driver may execute a "rewind" function by switching sequentially through channels having program start times which are a single time increment later in time. The switching must be done at a rate which exceeds the time offset increment between channels. For the example above having a time offset increment of one second, a rewind function is achieved by switching channels at a rate greater than one per second.

It is easy to appreciate that any rewind speed is therefore possible. The rewind speed is the ratio of the program offset time to the channel switching time. Since the channel switching time is essentially variable without limit for electronic systems, the rewind speed is perfectly dynamic.

Indeed, a user may merely specify a point in the program sequence or a certain elapsed time. The command driver can "rewind" in an instant to that point by using the look-up table to compute and direct the demultiplexer to tune to the channel which would be presently playing that corresponding program time.

A "Fast Forward" function works as follows:

Of course, a fast forward works in an analogous way but where the channel advance goes in the opposite direction. Changing to channels having a ***later*** program start time affects a rewind operation. Changing channels in the reverse direction, i.e. changing sequentially through channels having an earlier start time affects a fast forward operation. Like a rewind operation, a fast forward operation is perfectly dynamic in speed and may be set to any desirable speed without limit. Systems which physically rewind or spool media do not enjoy this great benefit. Even a random access device such as a CD ROM player must move a drive head to a certain track thus requiring an delay or seek time. Systems of the invention perform rewind, fast forward and other function without any moving parts. The speed of electronic switching, is for all practical purposes, without limits when used as described above.

A "Freeze Frame" function works as follows:

A "freeze-frame" function may operate identically to the pause function except that a single frame from the program is repeatably sent to the receiver output.

Therefore, a command driver may execute a freeze frame by executing a pause function while additionally executing the function of performing a loop to repeat a single frame to the output.

"Slow Motion" and "Fast Motion" functions work as follows:

"Slow and fast motion" functions can be performed similarly to the rewind and fast forward functions described above. Channels are changed sequentially in time at a rate greater than the time increment between program start times on adjacent channels. While channels are being changed, a frame-by-frame signals may be played at the receiver output. As described, the speed of rewind and fast forward are continuously dynamic. Any speed may be realized by appropriate electronic switching. Therefore, slow and fast motion functions may also be realized at any speed which can be selectable by a user.

The previous examples are good illustrations of how well organized multi-channel broadcasts can be manipulated at a receive-only end to affect desirable functions.

Although the present invention has been described in considerable detail with clear and concise language and with reference to certain preferred versions thereof including the best mode anticipated by the inventor, other versions are possible. Therefore, the spirit and scope of the appended claims should not be limited by the description of the preferred versions contained therein.

CLAIMS

1) An apparatus for transmission of information comprising:

a receive only terminal;

a transmit only terminal; and

a transmission link,

said terminal ends each being coupled to said transmission link,

said transmission link being comprised of a plurality of transmission channels, each channel being arranged to carry an identical signal whereby transmission of a signal on a first channel having an offset in time with respect to transmission of a signal being transmitted on a second channel.

2) An apparatus of claim 1, said transmission link being comprised of any number 'n' of channels having transmitted thereon an identical signal, each signal on each channel being displaced in time by an even time increment.

3) An apparatus of claim 2, said transmit only terminal further comprising a multiplexer characterized by a single input and a plurality of outputs, whereby a signal on said input is distributed to each of said outputs sequentially in time.

4) An apparatus of claim 1, said receive only terminal having a demultiplexer characterized by a plurality of inputs and a single output, whereby a signal received on either of the inputs is delivered to the output.

5) An apparatus of claim 4, said demultiplexer being further comprised a command driver coupled to each of the inputs arranged for switching the inputs to couple them to the output.

6) An apparatus of claim 5, additionally comprising a user interface device coupled to said command driver, said user interface device comprising a means to receive user inputs and respond thereto by stimulating said command driver.

7) An apparatus of claim 5, said demultiplexer further comprising channel switching means to affect a rewind function.

8) An apparatus of claim 5, said demultiplexer further comprising channel switching means to affect a fast forward function.

9) An apparatus of claim 5, said demultiplexer further comprising channel switching means to affect a pause function.

10) An apparatus of claim 5, said demultiplexer further comprising channel switching means to affect a start function.

11) An apparatus of claim 5, said demultiplexer further comprising channel switching means to affect a stop function.

12) An apparatus of claim 5, said demultiplexer further comprising channel switching means to affect a freeze frame function.

13) An apparatus of claim 5, said demultiplexer further comprising channel switching means to affect a slow motion function.

14) An apparatus of claim 5, said demultiplexer further comprising channel switching means to affect a fast motion function.

15) An apparatus of claim 5, said transmission link further comprising an ancillary channel dedicated to transmission of a schedule of transmission protocol including a matrix of channels and corresponding program start times.

16) An apparatus of claim 15, said demultiplexer further comprising channel switching means to affect a rewind function.

17) An apparatus of claim 15, said demultiplexer further comprising channel switching means to affect a fast forward function.

18) An apparatus of claim 15, said demultiplexer further comprising channel switching means to affect a slow motion function.

19) An apparatus of claim 15, said demultiplexer further comprising channel switching means to affect a fast motion function.

20) An apparatus of claim 5, said transmission link further comprising:

an ancillary channel dedicated to transmission of special non-program data coupled to a memory for storage of the non-program data, and a processor operable for transmitting the non-program data to receiver output during execution of command driver functions.

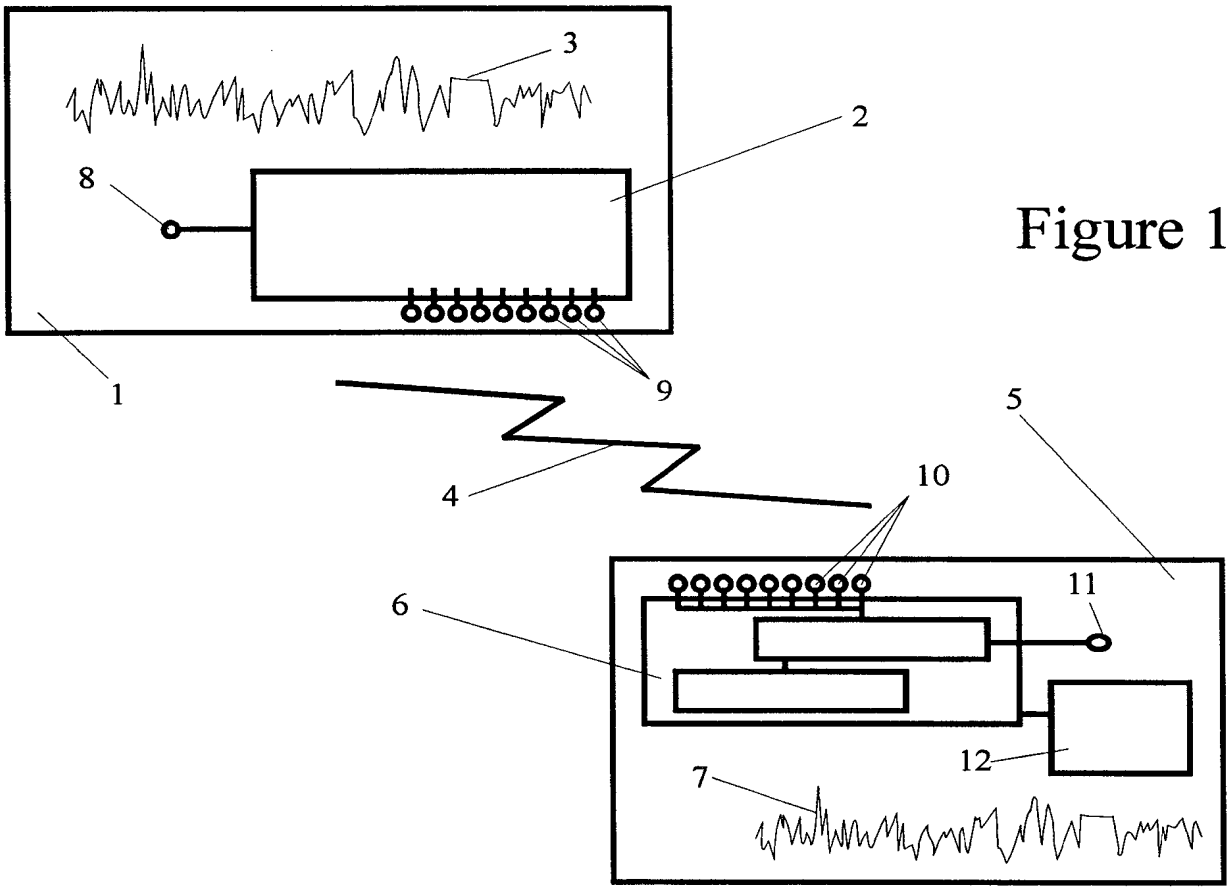

Figure 1

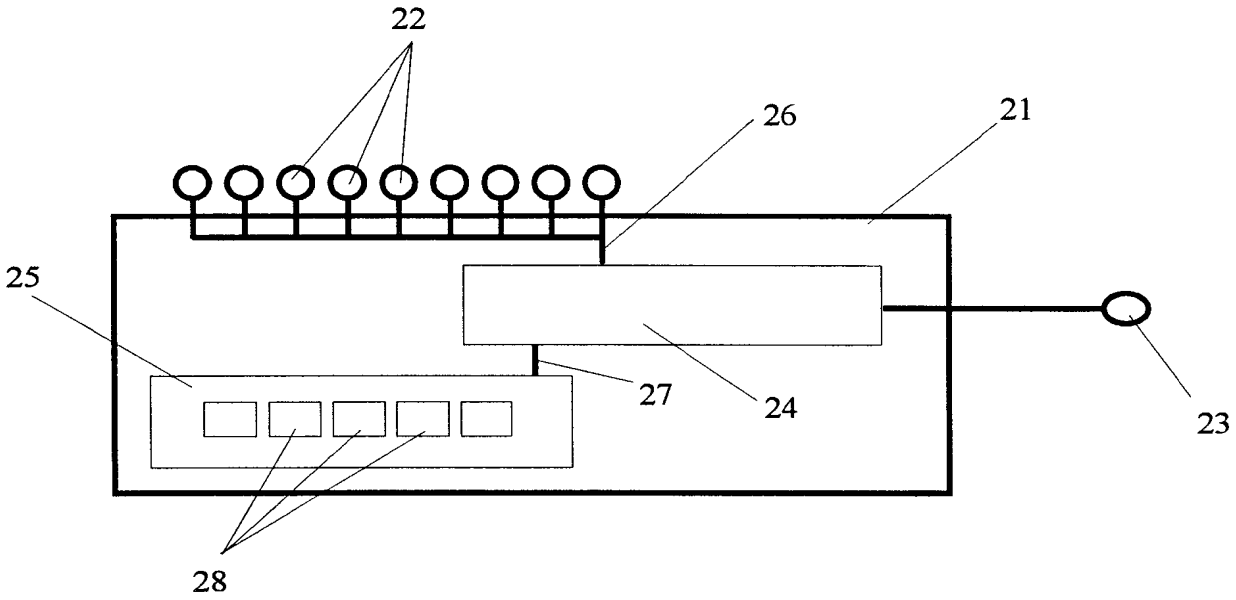

Figure 2

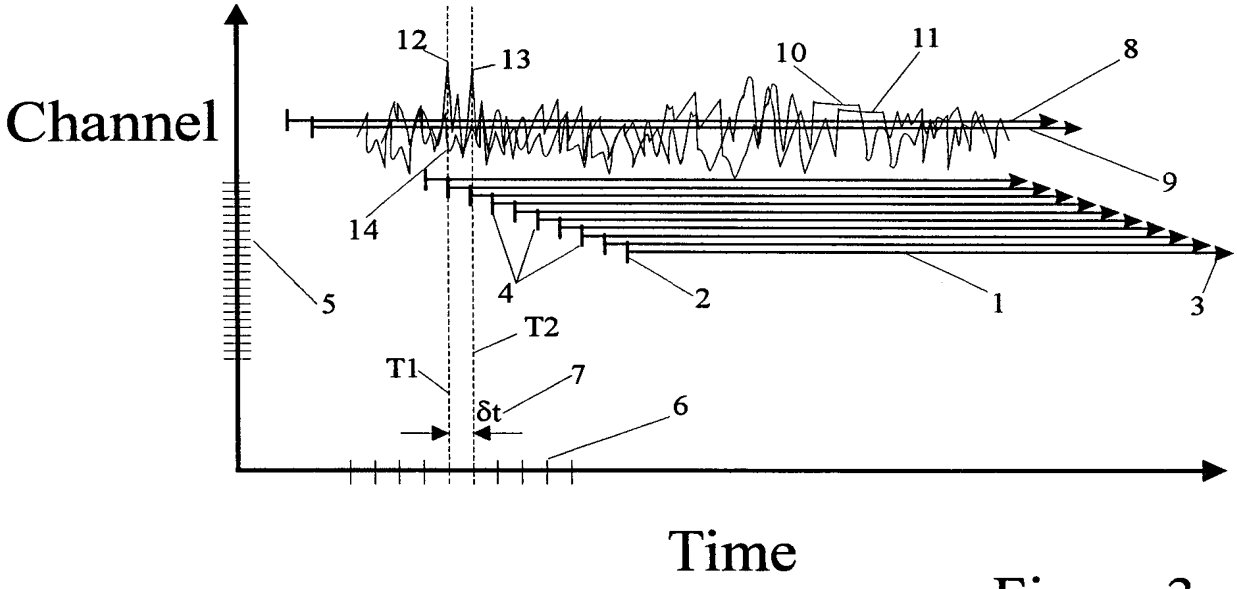

Figure 3

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US98/13638

A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) :H04N 7/10, 7/14
US CL :348/7, 6, 10; 455/4.2, 3.1, 6.1, 6.2, 6.3
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 348/7, 6, 10; 455/4.2, 3.1, 6.1, 6.2, 6.3

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

None

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

APS - one-way, cable, VOD, NVOD, receiver, transmitter, MUX, DMUX

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5,477,263 A (O'CALLAGHAM et al) 19 December 1995, col. 4 line 13 - col. 5 line 62, col. 6 lines 23 - 67, col. 8 line 64 - col. 9 line 26	1-20
X	US 5,357,276 A (BANKER et al) 18 October 1994, col. 2 line 42 - col. 2 line 68, col. 3 line 34 - col. 4 line 18, col. 11 line 43 - col. 12 line 68, fig. 1, fig. 10	1-20
A	US 5,513,011 A (MATSUMOTO et al) 30 April 1996	1-20

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

*	Special categories of cited documents:	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A"	document defining the general state of the art which is not considered to be of particular relevance	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E"	earlier document published on or after the international filing date	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)		
"O"	document referring to an oral disclosure, use, exhibition or other means		
"P"	document published prior to the international filing date but later than the priority date claimed	"&"	document member of the same patent family

Date of the actual completion of the international search 10 SEPTEMBER 1998	Date of mailing of the international search report 15 OCT 1998
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